TABLE 3.—*Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during November, 1929*

Altitude m. s. l.	Broken Arrow, Okla. (233 meters)		Burlington, Vt. (132 meters)		Cheyenne, Wyo. (1,868 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Havre, Mont. (762 meters)		Jacksonville, Fla. (65 meters)		Key West, Fla. (11 meters)		Los Angeles Calif. (10 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Meters	°		°		°		°		°		°		°		°		°		°	
Surface	N 28 W	0.7	S 20 W	2.7	N 73 W	6.8	N 13 E	0.6	N 62 W	3.2	N	2.4	S 68 W	3.1	N 15 W	0.6	N 66 E	2.6	N 53 W	2.7
500	N 88 W	2.2	S 40 W	6.2			S 58 W	0.7	N 65 W	4.1	N 31 E	3.4			S 28 E	1.0	N 84 E	6.6	N 77 E	0.2
1,000	N 89 W	4.3	S 72 W	7.5			N 78 W	3.7	N 52 W	7.1	N 17 W	2.1	S 87 N	7.1	S 12 W	1.7	S 73 E	5.5	N 87 E	0.5
1,500	N 72 W	5.1	S 85 W	9.6			S 84 W	8.4	N 56 W	9.0	N 87 W	3.9	N 59 W	10.1	S 52 W	3.0	S 59 E	4.5	N 48 E	2.2
2,000	N 73 W	7.5	N 85 W	11.4	N 68 W	9.4	S 87 W	11.5	N 62 W	10.0	N 83 W	7.5	N 54 W	10.7	S 69 W	4.0	S 64 E	3.3	N 44 E	3.8
2,500	N 78 W	10.6	N 89 W	12.6	N 50 W	11.4	N 89 W	14.1	N 56 W	11.4	S 85 W	9.5	N 60 W	11.7	S 68 W	5.0	S 66 E	2.3	N 31 E	5.6
3,000	N 80 W	13.2	W	13.0	N 42 W	10.2	S 89 W	14.5	N 59 W	11.1	S 72 W	10.2	N 53 W	11.8	S 65 W	3.3	S	0.6	N 8 E	5.7
4,000	N 89 W	16.2			N 46 W	9.4	S 84 W	19.5							S 71 W	4.1	S 62 W	3.1	N 4 W	2.1
5,000							S 79 W	16.3							N 81 W	8.1	S 69 W	4.0		

Altitude m. s. l.	Medford, Oreg. (446 meters)		Memphis, Tenn. (145 meters)		New Orleans, La. (25 meters)		Omaha, Nebr. (313 meters)		Royal Center, Ind. (225 meters)		Salt Lake City, Utah (1,290 meters)		San Francisco, Calif. (60 meters)		Sault Ste. Marie, Mich. (198 meters)		Seattle, Wash. (67 meters)		Washington, D. C. (34 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direc tion	Velocity
Meters	°		°		°		°		°		°		°		°		°		°	
Surface	S 32 W	0.2	N 14 E	0.8	N 42 E	1.6	N 65 W	1.3	S 69 W	2.1	S 40 E	1.4	N 75 E	1.1	S 24 W	1.0	N 46 E	0.9	N 81 W	1.2
500	S 29 W	0.1	N 11 W	1.6	N 47 E	3.2	N 58 W	4.0	N 86 W	5.6			N 7 E	3.1	S 64 W	4.0	N 42 E	1.3	S 87 W	7.4
1,000	S 66 E	1.6	N 26 W	4.8	N 50 W	1.2	N 54 W	6.5	N 80 W	9.0			N 15 E	5.9	S 80 W	7.2	N 39 E	0.7	N 75 W	8.4
1,500	S 63 E	1.8	N 68 W	5.9	N 80 W	3.8	N 57 W	7.5	N 80 W	10.3	S 16 E	2.0	N 10 E	5.4	S 86 W	7.3	N 5 W	2.2	N 88 W	12.6
2,000	N 34 E	2.2	N 83 W	8.6	S 83 W	4.9	N 67 W	8.2	N 82 W	12.5	S 44 W	1.2	N 3 E	4.7	N 77 W	9.1	N 2 E	3.1	N 86 W	16.0
2,500	N 11 E	5.3	S 81 W	9.9	S 89 W	7.6	N 73 W	7.9	S 87 W	12.0	N 55 W	3.3	N 5 E	4.8	N 25 W	8.3	N 12 W	4.5	S 88 W	15.8
3,000	N 4 E	6.8					N 65 W	8.3	N 72 W	13.7	N 28 W	7.8	N 2 E	6.1					S 80 W	16.2
4,000	N 14 W	6.6					N 61 W	7.1			N 21 W	11.2	N 11 E	5.8						
5,000											N 23 W	15.9								

TABLE 4.—*Observations by means of kites, captive and limited-height sounding balloons, during November, 1929*

	Broken Arrow, Okla.	Due West, S. C.	Ellendale, N. Dak.	Groesbeck, Tex.	Royal Center, Ind.
Mean altitudes (meters) m. s. l., reached during month	2,836	2,264	3,389	1,940	2,539
Maximum altitude (meters) m. s. l., reached and date	[1] 6,131	[3] 3,616	[3] 5,188	[4] 2,749	[3] 4,024
Number of flights made	27	29	33	16	24
Number of days on which flights were made	26	27	30	16	24

[1] 22d. [2] 14th. [3] 15th. [4] 6th. [5] 19th.

In addition to the above there are approximately 120 pilot-balloon observations made daily at 50 Weather Bureau Stations in the United States.

WEATHER IN THE UNITED STATES

THE WEATHER ELEMENTS

By P. C. DAY

GENERAL SUMMARY

The outstanding features of the weather during November were the marked cold over the districts from the Mississippi River eastward to the Atlantic coast at the end of the month, and the continued drought over the area from the Rocky Mountains to the Pacific coast, particularly in the more westerly portions where precipitation had been deficient for many months, and the season up to the end of November had been the driest ever known. This drought continued into December, but was partly broken in the first decade of that month and rather fully relieved by the middle of the month.

PRESSURE AND WINDS

At the beginning of the month an extensive area of precipitation had overspread much of the country from the Great Plains eastward, but precipitation was generally light save in a few small areas. By the morning of the 2d precipitation had largely ceased save over a narrow area extending from southern Texas northeastward to New England, continuing over practically the same area, but moving slightly eastward during the following two days, the falls becoming comparatively heavy locally during the 4th along or near the coast from central Georgia northeastward to the Chesapeake Bay region, the rain area practically disappearing beyond New England by the morning of the 5th.

At the morning observation of the 6th, low pressure had advanced into the central Plateau without much precipitation, and during the following 24 hours it moved to central New Mexico, attended by snows in the middle mountain region, and some rains had fallen in Texas and near-by areas. The pressure in that locality continued to fall, and, by the morning of the 8th, rain or snow had overspread a considerable portion of the southern Plains, and had extended into the west Gulf sections, continuing on the 9th over much of the same territory, the falls becoming locally heavy in portions of Texas and near-by areas. This rain area continued into the 10th, extending northward to the Great Plains and to near the western upper Lake region, with local heavy rains continuing in the coast districts of Texas. This area did not develop much strength and passed to the northward of the Great Lakes by the morning of the 11th, the precipitation extending eastward and southward into the lower Lake region, Ohio Valley, and Middle Gulf States, the area finally passing northeastward into the lower St. Lawrence Valley by the following morning.

Immediately following this, cyclonic conditions had moved from the Southwest but without material precipitation until the morning of the 12th, when rain had set in over a rather broad area from central Texas to the southern Appalachians and light snows were falling over the Middle Plains. By the following morning precipitation had become rather general from the eastern Plains to the Great Lakes and Appalachian Mountains. A second low-pressure area from the central Gulf during the 13th reinforced the depression, and by the morning of the 14th the center of the disturbance had moved to the lower Ohio Valley, while heavy rains had occurred over large portions of the Middle Gulf and Ohio Valley States, with the rain area extending northeastward to New England. Rain continued into the 15th over most eastern districts, the falls continuing heavy in Alabama and portions of Mississippi and other nearby States, though clearing in many districts by the morning of the 16th. However, rains continued over much of the Southeast, extending into the middle Appalachian region during the 17th, and into nearly all Atlantic coast and Great Lakes districts during the following two days.

Local light snows occurred in the northern Plains during the 20th to 22d, and rains had overspread much of the Gulf region by the morning of the last-named date, changing to snow in the southern drainage basin of the Ohio River, which during the 23d extended eastward to the south and middle Atlantic coasts, the precipitation becoming heavy in most eastern sections of the rain area.

Some light precipitation, mostly snow, occurred over northern districts during the period 23d to 26th, and rather general precipitation occurred over the Gulf districts on the last-named date; also snow or rain continued from that time to the end of the month at many scattered points in both the northern and central districts east of the Rocky Mountains.

Sea-level pressures were well above the normal over all central and western districts, anticyclonic conditions existing to a marked extent in the far Northwest, and thence southeasterly to the Great Plains and west Gulf States.

Cyclonic conditions existed over the eastern third of the country, and much cloudy, rainy weather persisted in that region.

Compared with the preceding October, pressure was higher, as is usually the case, in all parts of the country, save over a small area from the Great Lakes eastward to near the Atlantic coast, where the average sea-level pressures were slightly less than in October.

As is frequently the case in late autumn, few severe storms occurred in any part of the country, and damage or loss by winds was at the minimum. Such few storms as were reported are summarized in the usual table at the end of this section.

TEMPERATURE

The first two decades were mainly free from extreme ranges in temperature, though minor changes were frequent, but no severe winter weather persisted over any extended area. However, beginning with the third decade winter weather set in over most districts from the Rocky Mountains eastward, and continued in most of that area with more or less severity throughout the remainder of the month.

The week that ended November 26 was cold over nearly all parts of the country and decidedly so over the interior districts, where the weekly averages ranged up to as much as 15° below normal. A few sections during this week had averages slightly above normal, notably southern Florida and the coast districts of central California.

The last three days of the month had temperatures well below the normal over many parts of the country from the Rocky Mountains eastward, severe cold extending into the central valleys and southern districts, with temperatures below freezing on the morning of November 30 over practically all the Gulf coast region, and into the northern districts of Florida. The minimum temperatures during this period were the lowest of record for November over a large area from the Ohio Valley eastward to the Atlantic coast, and even in the far South many stations reported this period as the second coldest of record for November in the last 50 years or more.

In the far West this period was moderately warm and no severe winter weather was reported from that section during the month.

For the month as a whole temperatures were below normal from the Great Lakes and Ohio Valley southward to the Gulf and westward to the Rocky Mountain region and portions of the north Pacific coast, save for a small area in North Dakota and eastern Montana, and thence northward into Canada. Over many portions of the central valleys the month was decidedly cold, particularly in the southern Plains and West Gulf districts, where a number of stations reported mean temperatures for the month as the lowest of record for November.

The highest temperatures of the month were reported during the first few days in the far western districts and in the eastern districts from the lower Mississippi Valley northeastward to the Great Lakes. In the central valleys the highest temperatures occurred very generally about the middle of the month. The highest reading, 98°, occurred on the 3d, and was reported from a point in the interior of southern California.

Minimum temperatures occurred mainly during the closing days of the month, particularly on the 30th in the more eastern districts, though in the Great Plains and mountain regions they occurred about the 21st and 22d, and in a few far Western States they occurred earlier in the month. Minimum temperatures of 32° or lower occurred at some point in each State, and temperatures below zero were reported as far south as Texas and thence northeast to New England. The lowest reported, −38°, occurred in the mountains of Wyoming.

PRECIPITATION

The monthly amounts of precipitation were heavy and above normal over a general area extending from eastern Texas northeastward to the lower Lakes and thence eastward to near the Atlantic coast where the falls were frequently twice or even three or more times the normal. To the eastward of this area along or near the south Atlantic coast and over Florida, the monthly amounts were much less, not exceeding 25 per cent of the usual falls in portions of Florida. A second area of precipitation in excess of the normal, though here the amounts were far less than in the area first referred to, the monthly amounts ranging up to twice and even three times the usual falls, covered the middle and southern Rocky Mountains and portions of near-by States. From central Texas northeastward to the upper Lakes, the precipitation was mainly less than the normal and over the entire northern border there was usually less than the normal precipitation, this being particularly true over the districts west of the Rocky Mountains and all other far

western sections, where there were extensive areas with little or no rain or snow during the entire month.

In much of this western area the precipitation was the least of record for November since observations began, or at most it was the second November of no precipitation in more than 50 years. At a few places in the northern Plateau region, November is usually the month of greatest precipitation, but in the present November these places were frequently entirely without precipitation.

As a result of this deficiency in precipitation the water supply is greatly depleted, rivers are at low stages, springs and wells have gone dry in many instances, the fire hazard has been greatly increased, and forest fires have been controlled only with difficulty; while vegetation has been greatly retarded, winter pasturage is largely exhausted, and much stock feeding has been necessary.

SNOWFALL

The distribution of snow partook largely of that of a winter month from the Rocky Mountains eastward, the falls being widely distributed and the amounts in localities the greatest of record for November.

From the Great Plains eastward to the Atlantic coast there was more or less snow in all save the more southern districts, the falls being unusually heavy so early in the season over a considerable area from northwest Texas to the southern Appalachian Mountains, where falls near the end of the month ranged from 6 to 8 inches or more.

Farther north the amounts usually were less, until over North Dakota and some near-by areas where some snow that fell late in October remained unmelted at the end of that month, and, with amounts that occurred during November, formed a covering of snow that remained unmelted throughout the month. The total falls were comparatively heavy in the northern parts of the upper Lake region and locally in northern New York, but in New England the amounts for the month were mainly moderate. In the Rocky Mountains and over their eastern foothills good depths of snow were reported generally, but there was little in much of the Plateau region and practically none in the Sierra Nevada and Cascade ranges, none being reported from the highest peaks in California, a condition rarely experienced in that State.

RELATIVE HUMIDITY

Over much of the country from the Rocky Mountains eastward the percentages of relative humidity were above the monthly normals, save for small areas from the upper Lakes northeastward. In portions of the Rocky Mountains the departures from the normal were large, ranging up to 15 to 20 per cent. On the other hand, west of the Rocky Mountains, the humidities as represented by the departures from normal were mainly far less than normal, as would also be indicated by the great lack of precipitation in that area. This general dryness was augmented by the large percentage of sunshine in that region which averaged nearly 100 per cent of the possible at many places in California and other portions of the Southwest.

SEVERE LOCAL STORMS, NOVEMBER, 1929

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the annual report of the chief of bureau]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Crossroads, N. Mex.	8					Heavy hail	Considerable damage to range over 50 square miles.	Official, U. S. Weather Bureau.
Portland, Me., and vicinity.	17–19					Ice	Public utilities, especially telephone and telegraph companies, suffer heavy loss; many shade trees stripped; factories closed.	Do.
Iowa (parts of)	27					Wind and sleet	Plate-glass windows broken; many small buildings in rural sections wrecked.	Do.
Des Moines, Iowa	29					Wind	Small out buildings demolished; plate-glass windows broken.	Do.

RIVERS AND FLOODS

By MONTROSE W. HAYES

There were overflows in November, 1929, in the South Atlantic States and the Ohio River basin, but they were of minor importance, except in the Tennessee River and in that part of the east Gulf drainage area lying between the Apalachicola and the Mississippi Rivers.

Excessive rains fell from the 10th to the 17th in northwestern Georgia, Alabama, Mississippi, and the Louisiana Parishes east of the Mississippi River. There were numerous falls amounting to 10 inches in eight days, and one station, Helena, Ala., had 15.97 inches. The rivers began to rise rapidly on the 12th and 13th, flood stages were reached about the 15th, and in the lower reaches the overflow continued until the 25th. The water levels were not particularly high, but the inconvenience and damage were relatively great on account of the general overflow of all the minor streams, and the long continued flood in the larger rivers. The following tabular statement is a summary of the statistics of loss and damage. The information, of course, is not complete, but represents the best that is available.

	Alabama River system	Tombigbee-Black Warrior Rivers	Pascagoula and Pearl Rivers	Tennessee River	Total
Buildings, highways, bridges, etc.	$27,450	$89,000	$36,000	$2,200	$154,650
Matured crops	71,100	24,200	3,600	31,000	129,900
Prospective crops	[1] 5,250	[2] 2,700			7,950
Movable property, including livestock	850	80,000	2,500		83,350
Suspension of business, including wages	15,300	103,000	48,200	14,500	181,000
Total	119,950	298,900	90,300	47,700	556,850

[1] 1,100 acres. [2] 1,200 acres.

The warnings issued were timely and adequate. The savings effected through their use have been reported to have been $127,000 on the Alabama River system, $229,000 in the valleys of the Black Warrior and the Tombigbee, $26,000 in the Pascagoula and Pearl Valleys, and $8,500 in the Tennessee Valley, a total of $390,500.